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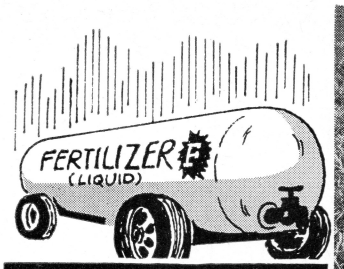

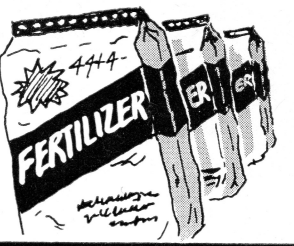

IOWA FARM SCIENCE

Better Pastures with Fertilization

by Frank W. Schaller and Regis D. Voss

IF YOU need more pasture or want to increase herd size, fertilization can be an economical way to do it. Production capacity of grasslands in pounds of beef per acre often can be doubled with the proper fertilization program.

Most pasture plants need nitrogen, phosphorus and potassium. Grasses are big users of nitrogen and yields will be low if this nutrient is inadequate.

Grasses respond to phosphorus and potassium, too, when supplies in the soil are low. Tests show that most pasture soils tend to be very low to low in phosphorus. The potassium supply is more variable among different soils than is phosphorus. Periodic soil tests will provide information on the kind and quantity of nutrients needed on your pastures.

Legume-grass pastures may not need nitrogen or only small amounts. Legumes fix nitrogen from the air for their own use, and provide some nitrogen the grass can use. If the forage stand is 50 percent or more legume, don't apply nitrogen. If the proportion of legume is much below 50 percent, the grass in the mixture is likely to respond to nitrogen.

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Nitrogen Rates

How much nitrogen (N) should you apply to grass pastures? Iowa State University suggestions range from 60 to 240 pounds of N per acre, depending on several factors. Your choice of rates should be influenced by the need for forage, the thickness of stand, kind of grazing management, grass variety, and moisture supply.

ISU studies show tallgrass yields usually increase at a near constant rate up to over 200 pounds of N per acre. The tallgrasses include bromegrass, orchardgrass, reed canary grass and tall fescue. Kentucky bluegrass has a lower yield potential and nitrogen response slows down at about 120 pounds of N per acre.

Suggested nitrogen rates for bluegrass and tallgrass pastures are presented in Table 1. The rates are lower for western Iowa than for the rest of the state. This reflects a difference in rainfall—26 to 30 inches annual precipitation in western Iowa, compared to 30 to 34 inches or more for the rest of the state.

THE HIGHER YIELD potential of tallgrass is illustrated here. In the left foreground is bluegrass pasture, compared to a tallgrass, reed canary, in the background. With higher yields, tallgrasses need more fertilizer.

TABLE 1. Nitrogen application rates for grass pasture.

Area	Lbs. per acre of N* Bluegrass	Tallgrass
NW Iowa	60	80
Western Iowa	70	100
Other areas	80	120

*Additional N up to double these rates can be used, but as a split application.

The rates shown in Table 1, 60 to 120 pounds of N per acre, are considered moderate rates and are best applied as a single application. Additional nitrogen—up to double these rates—can be used in a split application. If you need forage, are practicing some type of rotation grazing, and if the moisture supply looks favorable, consider the higher fertilization rates. Applying high annual rates of nitrogen in at least two applications is safer, allows better use of the N and more total yield for the year.

What Kind of Nitrogen?

Use only the dry forms of nitrogen or non-pressure solutions when topdressing. The dry forms include ammonium nitrate (33.5-0-0) and urea (45-0-0). The non-pressure solutions usually contain both ammonium nitrate and urea and range from 28 to 32 percent elemental nitrogen. Nitrogen in these forms will not be lost to the air when broadcast or sprayed on pasture sods with one exception. It is sometimes possible to lose some ammonia from breakdown of urea. This is not usually serious, however.

When properly applied, equal amounts of N from these materials produce equal results. Therefore, it usually pays to check prices on the different materials, as prices may vary, depending on availability in a specific area. At the suggested rates and with proper application, there should be no serious burning of the grass.

Because of its low cost, there is interest in using anhydrous ammonia on pastures. This material must be knifed-in and sealed. This presents problems on grass sods. Research is underway to develop special applicators and to study yield response with anhydrous ammonia. More study is needed before its use in fertilizing grass sods can be suggested.

When to Apply N

There are choices also as to when to apply nitrogen. The choices should be based on facts and your plans to meet forage needs. The best time to apply nitrogen on pastures is influenced mainly by the growth pattern of the grass, and to a lesser degree, by the need for pasture and convenience of application.

Bluegrass and the tallgrasses mentioned are cool season grasses. They make their major growth during May, June and up to about mid-July. Growth is nearly at a standstill during the hot weather and frequently dry soil conditions from mid-July through August. Then, as the weather starts to cool in late August and the moisture supply improves, growth picks up again and continues into October. Adequate nitrogen must be available during these two periods of best growth for top grass yields.

When you increase grass production by fertilization, you must be prepared to use the forage about the time it is produced. However, it doesn't all have to be grazed at this time. It may be convenient to cut some for storage or allow some growth to accumulate for later grazing.

If you choose to use a single nitrogen application at a moderate rate, for example, 80 pounds of N for a bluegrass pasture and 120 pounds for a bromegrass pasture, an excellent time to apply it would be early spring before major growth starts. The ground surface may still be frozen, but don't spread fertilizer on snow. Fertilizer could be lost if the snow melts rapidly and runs off instead of into the soil.

Single applications also can be made in early August or late fall before the ground freezes. The early August application will boost fall growth and some may carry over to spring. Response from the late fall treatment will occur the following spring. Fall is a convenient time to apply nitrogen fertilizer but sometimes response is less than from the same amount spring applied.

A moderate rate of nitrogen applied in early spring or the previous fall will allow you to turn cattle out earlier and insure favorable production during spring and early summer. But a moderate application of N would be used up largely during this period. So if you wish to continue high production during the late summer-fall period, additional nitrogen would be needed.

For example, you might make a second application in early August of 40 to 60 pounds of N on bluegrass and 80 to 100 pounds on tallgrasses. If late summer-early fall rainfall was favorable, response would be high. If the period stayed dry, response might be low, but the nitrogen would then carry-over to the following spring.

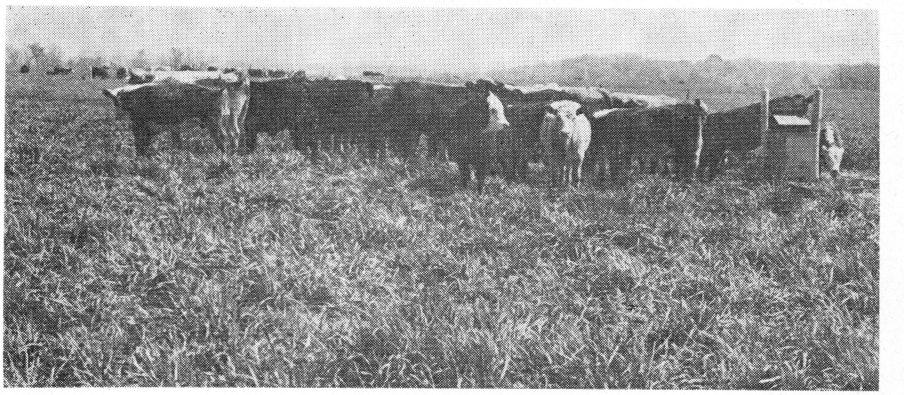
Another high rate split application program calls for 80 pounds of N on bluegrass or 120 pounds on tallgrass in early August. This will stimulate top fall growth and boost grass vigor for a fast start the following spring. This nitrogen will increase early spring growth, but will be used up quickly. So a second application is made about June 1—60 pounds of N on bluegrass and 100 pounds of N on tallgrass. A similar system of nitrogen application has produced nearly 600 pounds of beef per acre at the Albia Research Farm during the past 3 years.

P,K for Grass Pastures

Don't overlook phosphorus and potassium when fertilizing pastures. Response on grass may not be as spectacular as with nitrogen but you can be sure it's needed if soil levels are low.

Suggested annual application rates for P_2O_5 and K_2O on Kentucky bluegrass and the tallgrasses are shown in Table 2. Rates for the tallgrasses are 10 to 20 pounds per acre higher than bluegrass because the tallgrasses yield more. An additional 10 to 20 pounds of P_2O_5 per acre should be added on calcareous soils.

The phosphorus and potassium rates in the table are based on soil test levels. If a soil test is not available, use the very low or low test values at least the first year of application. Then test your soil and



THIS IS ONE of the tallgrass pastures used in the Albia Research Farm program where 600 pounds of beef per acre were produced. The program emphasized high split applications of nitrogen and rotation grazing.

adjust accordingly. In any case, test soil every 3 to 4 years. You may find phosphorus and potassium levels will increase after a few years of fertilization and the annual rates can then be reduced.

Timing applications of phosphorus and potassium is not critical. Many farmers apply them once each year along with a nitrogen application. If nitrogen is always applied separately, it might be more convenient to double the phosphorus and potassium rate, apply it in early spring or fall and let it last for 2 years.

P,K for Legume-Grass

Annual phosphorus and potash application rates for legume-grass pastures are presented in Table 3. Such pastures would include birdsfoot trefoil and grass, alfalfa-grass or crownvetch-grass.

Phosphorus rates are the same for legume mixtures as for tallgrasses. But the potassium rates are 10 pounds higher at each soil test level for the legume-grasses. Legumes require more potassium than do the grasses. Each of the rates shown in the table should be increased 20 pounds per acre for calcareous soils.

Again, time of application for phosphorus and potassium on legume-grass pastures is not critical. However, early spring or early August are favored. Applications can be made each year, or you can double the rates and apply every other year.

TABLE 2. Annual phosphorus and potassium application rate for grass pastures.

Soil Test Class	Lbs. per acre*			
	Bluegrass		Tallgrass	
	P_2O_5	K_2O	P_2O_5	K_2O
Very low	40	30	60	50
Low	30	20	40	40
Low-Medium	20	10	30	20
Medium or High	0	0	0	0

*An additional 10 to 20 pounds of P_2O_5 per acre should be added on calcareous soils.

TABLE 3. Annual phosphorus and potassium application rates for legume-grass pastures.

Soil Test Class	Lbs. per acre*	
	P_2O_5	K_2O
Very low	60	60
Low	40	50
Low-Medium	30	40
Medium	0	20
High	0	0

*Increase 20 pounds per acre for calcareous soils.

What About Lime?

The use of limestone to reduce acidity is a profitable practice. For pastures, best results are obtained when limestone is plowed down or disked in at time of establishment. It usually doesn't pay to topdress pastures which have moderate acidity or less. Only if the soil pH is much below 6.0 should you consider topdressing with lime.

Other Considerations

Fertilizer will stimulate weed growth as well as grasses and legumes in a pasture. Clip to control weeds or spray grass pastures with 1 to 1½ pounds of 2,4-D per acre. An early June spraying will give best weed kill. Cattle should be off the pasture for 7 days after spraying.

Even with 2,4-D, it may be necessary to clip once to control hard-to-kill weeds. Legume pasture cannot be sprayed. Because 2,4-D will injure all legumes, clip this type only. Eliminating weeds will allow grass and legume stands to thicken faster, and more of the soil nutrients and water will be available to the desirable species.

For best fertilizer response, delay the start of spring grazing until the grass and legumes are well started. Then avoid overgrazing. Maintain some leaf area at all times. If possible, have several pastures so cattle can be moved for efficient forage use. Building fences and providing water are vital if fertilizer benefits are to be fully realized. Only in this way can grasses and legumes develop strong root systems and carry on growth processes which allow yield potential.

In Conclusion

Fertilization is of prime importance in any efficient highly productive forage program. Years of research and farmer experience have demonstrated large increases in days of grazing and beef production per acre by fertilizing low yielding pastures. On dry matter yields alone, you should expect at least a $2 return for each $1 spent for fertilizer. Nevertheless, best returns from pasture fertilization will depend on effective utilization through a well-managed livestock program. You must manage both forage and livestock properly.